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PATENT ABSTRACTS OF JAPAN

(54) APPARATUS AND METHOD FOR DATA COMMUNICATION

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a cache server that can serve a service with the same quality as that of a media server.

SOLUTION: A client 3 transmits a distribution request for requesting distribution of streaming of a particular media file to the media server 2a cache confirmation section 10 of the cache server 1 receives the distribution requestconfirms whether or not the media file being the request object is stored in a cache file storage section 101 as the cache filea file streaming distribution section 19 uses the cache file to distribute the streaming to the client 3 when being storedthe cache confirmation section 10 transmits the distribution request to the media server 2 when not storedthe media server 2 distributes the streamingand a media file acquisition section 17 of the cache server acquires the media file being the request object from the media server 2 in parallel and stores the file to the cache file storage section 101.

CLAIMS

[Claim(s)]
[Claim 1]A terminal unit which requires streaming of one of information data characterized by comprising the followingA data communication unit which communicates between distribution systems which perform streaming of information data which held at least one or more information data files in which each contains at

least one or more information dataand in which streaming was demanded from said terminal unit.
A file storing part which can store one of information data files.
A distribution request receive section which receives a distribution request which requires streaming of information data more specific than said terminal unit.
It is checked whether an information data file containing demand information data in which streaming was demanded in said distribution request is stored in said file storing partA data authentication part required as transmitting said distribution request to said distribution systemand carrying out streaming of said demand information data to said terminal unit when an information data file containing said demand information data is not stored in said file storing part.
Said demand information data.

[Claim 2]When an information data file containing said demand information data is further stored in said file storing partsaid data communication unitThe data communication unit according to claim 1 having a data distribution part which carries out streaming of said demand information data to said terminal unit from said file storing part.

[Claim 3]A communication rate judgment part which judges a still more nearly usable communication rate to reception of said demand information data file by said file receive section in said data communication unitBased on an usable communication rate judged by said communication rate judgment partHave a communication rate set part which sets up a communication rate used for reception of said demand information data file by said file receive section as a setting communication rateand said file receive sectionThe data communication unit according to claim 1 receiving said demand information data file at said setting communication rate set up by said communication rate set part.

[Claim 4]Said data communication unit is connected with said distribution system via two or more communication paths.
Said data communication unit has a communication-path selecting part which chooses further a communication path used for reception of said demand information data file by said file receive section from said two or more communication pathsThe data communication unit according to claim 1wherein said file receive section receives said demand information data file using a communication path with said selected communication-path selecting part.

[Claim 5]Furtherwhenever a distribution request is transmitted to said distribution system by said data authentication partsaid data communication unita distribution request which calculates accumulation of transmission frequency of a distribution request about demand information data of each distribution request -- calculation -- having a partsaid file transmission demand partsaid distribution request -- calculation

-- the data communication unit according to claim 1wherein enumerated data by a part transmit said file transmission demand to said distribution system only about demand information data beyond a predetermined threshold.

[Claim 6]Said data communication unit further a communication rate used for reception of said demand information data file by said file receive sectionHave a dynamic communication rate set part dynamically set up at the time of reception of said demand information data file by said file receive sectionand said file receive sectionThe data communication unit according to claim 1 receiving said demand information data file with a communication rate dynamically set up by said dynamic communication rate set part.

[Claim 7]Before said file storing part completes storing of said demand information data fileWhen said distribution request receive section receives a distribution request about said demand information data from new terminal units other than said terminal unitsaid data distribution partThe data communication unit according to claim 2 characterized by carrying out streaming of said demand information data to said new terminal unit from said file storing part after said demand information data file is stored in said file storing part.

[Claim 8]Before it has the following and said information data storage completes storing of said request-to-receipt information dataWhen said distribution request receive section receives a distribution request about said demand information data from new terminal units other than said terminal unitsaid data distribution partThe data communication unit according to claim 2 carrying out streaming to said new terminal unit one by one from a portion stored in said information data storage among said request-to-receipt information data.

An information data receive section which receives demand information data in which streaming of said data communication unit was further carried out to said terminal unit from said distribution system.

Information data storage which stores request-to-receipt information data received by said information data receive section.

[Claim 9]The data communication unit according to claim 8wherein said data communication unit has further a data deletion part which deletes information data in which it overlaps in said information data storage when information data in said file storing part and information data in said information data storage overlap.

[Claim 10]A terminal unit which requires streaming of one of information data characterized by comprising the followingA data communication method which communicates between distribution systems which perform streaming of information data which held at least one or more information data files in which each contains at least one or more information dataand in which streaming was demanded from said terminal unit.

A file record step which can record one of information data files.

A distribution request receiving step which receives a distribution request which requires streaming of information data more specific than said terminal unit.
It is checked whether an information data file containing demand information data in which streaming was demanded in said distribution request is recorded by said file record stepA data authentication step required as transmitting said distribution request to said distribution systemand carrying out streaming of said demand information data to said terminal unit when an information data file containing said demand information data is not recorded by said file record step.
Said demand information data.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]Between the client in which this invention reproduces streaming dataand the media server which distributes streaming data is connected in the network of one or more kinds.
By carrying out the cash advance of the streaming data by a cache server about the streaming data distribution system with which a cache server exists between a client and a media server's networkA media server's load is distributed and it is related with the cache server device and caching method for reducing confusion of the network between media servers from a client.
As a network which distributes streaming datathe Internetdigital television broadcastingsatellite communicationetc. shall include all the means of communication of a cable and radio.
[0002]
[Description of the Prior Art]In the streaming system through a networkthe streaming data distributed by the media server follows a protocolis divided finely and distributed. A client reproduces this datareceiving the divided data. In the cache server device located between a client and a media server. The cash advance (accumulation) of the streaming data transmitted and received among media servers is carried out to a clientand a cache server device to streaming is performed instead of a media server according to the same streaming data request from other clients. It can avoid that the demand of a client concentrates on a media server as mentioned aboveand a network traffic load can be decreased. The proxy for video-on-demand systems via a network which performs such behavior is indicated to JP2001-69485A.
[0003]Since streaming data is not static datait is necessary to generally transmit [data] and receive predetermined data in fixed time. For examplestreaming of the media data which has a certain fixed regeneration time like an image or a sound is

carried out maintaining real time nature from a media serverand a client reproduces with a receipt the streaming data in which streaming was done by the media server one by one. The device and method which perform a cash advance in consideration of the characteristic of this streaming data are indicated to JP2000-293424A. When this carries out the cash advance of the streaming data according to the demand of a clientInstead of a cache server device being a client even if the demand of a client is interrupted on the waythe data for the time of streaming data to have is acquired from a media serverand it accumulates in cash.

[0004]

[Problem(s) to be Solved by the Invention]Generallyby streamingsince importance is attached to the real-time reproduction according to the demand of the clientit distributes using the protocol which is easy to maintain real time nature in many cases. Howeverwhile such protocols skipped the procedure of checking that it has been sent to the transmission destination and have simplified transmitting and receiving processingthey do not guarantee that the streaming data by which streaming is carried out arrives at a transmission destination. Thereforeit may be generated by missing data depending on a network congestion state.

[0005]In the conventional methodif it is generated by missing data as mentioned above when carrying out the cash advance of the streaming dataa cache server will store the streaming data except this missing data to cashand will be taken as cache data. In this casethe accumulated cache data are insufficient of this missing data compared with the streaming data distributed by the media server. When the same streaming demand occurs from other clients in this stateOr it cannot perform streaming from a cache server devicethere is a problem of distributing the streaming data in the state where data was missingfrom a cache server.

[0006]The media file stored in a media server in order to perform streaming has included two or more related streaming data in many cases. For examplethere are some etc. in which the streaming data of two or more quality is contained in one media file by the same contents. Out of two or more qualityaccording to the network bandwidth and a user's use which carry out streamingone or more streaming data is chosen and this kind of media file is used. Selection is consideredalso when the best quality is automatically selected from terms and conditionsor a media server and a client are concerned with a situation and specify intentionally [there is nothing and / a user]. The media file whichin addition to thiscollapsed the image (multi-angle) photoed from two or more anglesStill Picture Sub-Division relevant to an animationetc. can be considered. Also in this casea media server will distribute only the streaming data which had the demand from the client.

[0007]In this casein the streaming data request from one client. The inside of two or more streaming data contained in one media fileStreaming only of the one streaming data is done by the media serverbut only one streaming data which the media server distributed is stored in cash with the conventional cache server device. That isit will

be said that related streaming data is not stored in cash. Even if the same media file is required from other clients in this statethe streaming data stored in cash may not suit the demand of a client. For examplesince it is lower than the streaming data quality (transfer rate) accumulated in cash when the bandwidth of the network of a client with a demand is narrowthe case of being incongruent etc. can be considered to the client. Thereforeeven if streaming cannot be performed from a cache server device or it carries out streaming from a cache server devicethere is a problem that reproduction on a client cannot be performed well.

[0008]To an ordinary homeADSL (Asymmetric Digital Subscriber Line)The spread of a CATV internetFTTH (FiberTo The Home)etc. progressesand ISP (Internet Service Provider) which is a temporary connection point can connect now at high speed. It has come to be able to perform reproduction of the media file which exists in ISP which each user has made a contract of by this at comparatively high speed. Howeversince it goes via two or more networks which constitute the Internet if the media file which is far away is reproducedit cannot but go via a network crowded also probable. Thereforeit is difficult from a media server direct reception and to reproduce in the media file than to which it becomes difficult from which to secure a zoneit is constituted by time seriessuch as an animation and a soundand greater importance is attached to real time nature.

[0009]Even if this invention was made in order to solve the above problemsand it has lack of the data at the time of streamingIt aims at realizing the cache server system which enables service equivalent to a media server by accumulating the media file which exists on a media serverand the file of the contents as a cache file.

[0010]Also about the streaming data in which this invention contains two or more related streaming dataBy making the demand from one client into a triggerand accumulating in cash by making a media file into a cache fileit sets it as other purposes to realize the cache server system which enables service of a media server and the quality.

[0011]This invention is applicable also to broadcasting or multicasting. Also concerning [namely] the streaming data distributed by the media server regardless of the demand of a client (a television broadcasting stationan Internet broadcasting officeetc.)It sets it as other purposes to carry out a cash advance and to realize the cache server system in which streaming is possible according to the demand from a client.

[0012]
[Means for Solving the Problem]A terminal unit with which a data communication unit concerning this invention requires streaming of one of information dataEach holds at least one or more information data files containing at least one or more information dataA file storing part which is a data communication unit which communicates between distribution systems which perform streaming of information data in which streaming was demandedand can store one of information data files from said terminal

unitA distribution request receive section which receives a distribution request which requires streaming of information data more specific than said terminal unitIt is checked whether an information data file containing demand information data in which streaming was demanded in said distribution request is stored in said file storing partWhen an information data file containing said demand information data is not stored in said file storing partWhen a data authentication part required as transmitting said distribution request to said distribution systemand carrying out streaming of said demand information data to said terminal unit and an information data file containing said demand information data are not stored in said file storing partA file transmission demand part which transmits a file transmission demand required as transmitting a demand information data file in which said demand information data is contained among information data files which said distribution system holds to said distribution systemHaving a file receive section which receives a demand information data file transmitted from said distribution system to said file transmission demandsaid file storing part carries out the feature of storing said demand information data file received by said file receive section.

[0013]Said data communication unit has a data distribution part which carries out streaming of said demand information data to said terminal unit from said file storing partwhen an information data file containing said demand information data is further stored in said file storing part.

[0014]A communication rate judgment part which judges a still more nearly usable communication rate to reception of said demand information data file by said file receive section in said data communication unitBased on an usable communication rate judged by said communication rate judgment partHave a communication rate set part which sets up a communication rate used for reception of said demand information data file by said file receive section as a setting communication rateand said file receive sectionSaid demand information data file is received at said setting communication rate set up by said communication rate set part.

[0015]Via two or more communication pathssaid data communication unit is connected with said distribution systemand said data communication unitHave a communication-path selecting part which chooses a communication path used for reception of said demand information data file by said file receive section from said two or more communication pathsand said file receive sectionSaid demand information data file is received using a communication path with said selected communication-path selecting part.

[0016]Furtherwhenever a distribution request is transmitted to said distribution system by said data authentication partsaid data communication unita distribution request which calculates accumulation of transmission frequency of a distribution request about demand information data of each distribution request -- calculation -- having a partsaid file transmission demand partsaid distribution request -- calculation -- enumerated data by a part transmit said file transmission demand to said

distribution system only about demand information data beyond a predetermined threshold

[0017]Said data communication unit further a communication rate used for reception of said demand information data file by said file receive sectionHaving a dynamic communication rate set part dynamically set up at the time of reception of said demand information data file by said file receive sectionsaid file receive section receives said demand information data file with a communication rate dynamically set up by said dynamic communication rate set part.

[0018]Before said file storing part completes storing of said demand information data fileWhen said distribution request receive section receives a distribution request about said demand information data from new terminal units other than said terminal unitsaid data distribution partAfter said demand information data file is stored in said file storing partstreaming of said demand information data is carried out to said new terminal unit from said file storing part.

[0019]An information data receive section which receives demand information data in which streaming of said data communication unit was further carried out to said terminal unit from said distribution systemIt has the information data storage which stores request-to-receipt information data received by said information data receive sectionBefore said information data storage completes storing of said request-to-receipt information dataWhen said distribution request receive section receives a distribution request about said demand information data from new terminal units other than said terminal unitsaid data distribution partStreaming is carried out to said new terminal unit one by one from a portion stored in said information data storage among said request-to-receipt information data.

[0020]Furthersaid data communication unit has a data deletion part which deletes overlapping information data in said information data storagewhen information data in said file storing part and information data in said information data storage overlap.

[0021]A terminal unit with which a data communication method concerning this invention requires streaming of one of information dataEach holds at least one or more information data files containing at least one or more information dataA file record step which is a data communication method which communicates between distribution systems which perform streaming of information data in which streaming was demandedand can record one of information data files from said terminal unitA distribution request receiving step which receives a distribution request which requires streaming of information data more specific than said terminal unitIt is checked whether an information data file containing demand information data in which streaming was demanded in said distribution request is recorded by said file record stepWhen an information data file containing said demand information data is not recorded by said file record stepWhen a data authentication step required as transmitting said distribution request to said distribution systemand carrying out streaming of said demand information data to said terminal unit and an information

data file containing said demand information data are not recorded by said file record stepA file transmission request step which transmits a file transmission demand required as transmitting a demand information data file in which said demand information data is contained among information data files which said distribution system holds to said distribution systemHaving a file receiving step which receives a demand information data file transmitted from said distribution system to said file transmission demandsaid file record step carries out the feature of recording said demand information data file received by said file receiving step.
[0022]
[Embodiment of the Invention]Embodiment 1. drawing 1 is a lineblock diagram showing the network environment to which the cache server of this invention is applied.
[0023]The media server 2the client 3and the cache server 1 are connected to the network 4. This network shall include all the communications departments of a cable and radiosuch as the Internetdigital television broadcastingand satellite communication. Two or more clientsmedia serversand cache servers may be connected to one networkrespectivelyand two or more networks may be connected to each device.
[0024]The media server 2 holds one or more media files by the media file storage 103. The media server 2 receives the demand of the client 3 via the network 4and performs streaming to this client 3 using a media file. At this timethe data which is the target of streaming is called streaming data. That in which streaming is done by the media server 2 is actually called distribution streaming data. Two or more related streaming data may be contained in the media file stored in the media server's 2 media file storage 103. It is the media file etc. which collapsed Still Picture Sub-Division relevant to the image (multi-angle) and animation which were specifically photoed from the case where the streaming data of two or more quality is contained in one media file by the same contentsor two or more anglesetc. Although the object of streaming data is data which mainly has fixed timesuch as an animation and a soundthe static data of Still Picture Sub-Divisiona textetc. is also good also as an object. Herethe media server 2 is equivalent to a distribution systemstreaming data is equivalent to information dataand a media file is equivalent to an information data file.
[0025]The client 3 receives the distribution streaming data in which streaming was done by the media server 2and performs reproductiona displayetc. while it transmits the distribution request which requires streaming of the media server 2 via the network 4. Herethe client 3 is equivalent to a terminal unit. The streaming data as which streaming was required by the distribution request is equivalent to demand information data.
[0026]The cache server 1 stores in cash the media file and streaming data which had the distribution request from the client 3and receives the distribution request from the client 3Streaming is performed using the media file and streaming data which are stored in cash. Let what accumulated in the cache file what accumulated the media

file in cashand stored streaming data in cash be cache data.Herethe cache server 1 is equivalent to a data communication unit.

[0027]Nextthe internal configuration of the cache server 1 is explained using drawing 2. The cache server 1 comprises the cache confirming part 10the media file acquisition part 17the file streaming part 19and the cache file storage 101.

[0028]The cache confirming part 10 receives the distribution request of the client 3and checks whether the media file containing the streaming data by which the distribution request was carried out from the client 3 is stored in the cache file storage 101 as a cache file. The place information of the streaming data by which the distribution request was carried out from the client 3 is managed. Place information means Server Namea media file nameetc. When the media file which contains the streaming data by which the distribution request was carried out from the client 3 as behavior of the cache confirming part 10 is stored in the cache file storage 101 as a cache fileThe file streaming part 19 is called so that streaming of the streaming data with a distribution request may be carried out from the cache file storage 101 to the client 3. When the media file containing streaming data with a distribution request is not stored in the cache file storage 101 as a cache fileTransmit the distribution request of a client to the media server 2and it is made to make streaming perform from the media server 2 to the client 3and the media file acquisition part 17 is called and a media file is acquired as a cache file. Herethe cache confirming part 10 is equivalent to a distribution request receive section and a data authentication part.

[0029]The media file acquisition part 17 is carried out based on the place information of the media file emitted from the cache confirming part 10and acquires a media file from the media server 2 via the network 4. When the media file which specifically contains the streaming data which had a distribution request from the client 3 is not stored in the cache file storage 101The media file Request to Send (file transmission demand) which requires transmission of the media file in which streaming data with a distribution request is contained is transmitted to the media server 2A media file is received as a response to a media file Request to Send from the media server 2. The media file in which streaming data with a distribution request is contained is equivalent to a demand information data file. A file transmission demand part and a file receive section deserve the media file acquisition part 17.

[0030]The file streaming part 19 uses the cache file accumulated in the cache file storage 101 according to the distribution request of the client 3and performs streaming to the client 3. The file streaming part 19 is equivalent to a data distribution part.

[0031]The cache file storage 101 stores the media file acquired by the media file acquisition part 17 as a cache file. The cache file storage 101 is equivalent to a file storing part.

[0032]Although the cache server 1 is not illustratingit is realizable by the computer which has a recording device of CPUssuch as a microprocessorsemiconductor

memoryetc. a magnetic disketc.and a means of communicationfor example. The program which realizes the function of each component included in the cache server 1 is recorded on the recording devicewhen CPU reads these programsoperation of the cache server 1 can be controlled and the function of each component can be realized.
[0033]Nextoperation is explained. Firstthe distribution request of arbitrary media files is published from the client 3 to the media server 2. If streaming is required of the media server 2 from the client 3this distribution request certainly goes via the cache server 1. The cache confirming part 10 receives the distribution request transmitted from the client 3and checks whether the media file which the client 3 is demanding is stored in the cache file storage 101 as a cache file.
[0034]When the media file which the client required is stored in the cache file storage 101 as a cache file (at the time of a hit)The file streaming part 19 uses the cache file stored in the cache file storage 101and performs streaming to the client 3 instead of the media server 2.
[0035]The cache confirming part 10 transmits the distribution request from this client to the media server 2 as a miss hitwhen this media file was not stored as a cache file and it checks. In this casein the media server 2streaming of the applicable streaming data is carried out in response to the demand from the client 3. Streaming of the streaming data is done by the media serverand a client receives this streaming data and is reproduced. In parallelthe cache confirming part 10 notifies the informationincluding the media server's 2 namean IP addressthe name of a media filesizeetc.which specifies a media file as the media file acquisition part 17and requires acquisition of a media file.
[0036]The media file acquisition part 17 transmits a media file Request to Send to the media server 2 based on the information received from the cache confirming part 10A media file applicable from the media server 2 is received as a cache fileand it stores in the cache file storage 101.
[0037]Herethe media file which is received by the media file acquisition part 17and is stored in the cache file storage 101 as a cache file contains the streaming data which had the distribution request from the client 3and the data relevant to this streaming data. That isthe cache server 1 will hold the media file and the file of an identical content which the media server 2 holds. For this reasonafter the media file acquired by the above processing by the media file acquisition part 17 is stored in the cache file storage 101Since this media file is accumulated as a cache file when the distribution request of this media file is made from another client to the media server 2It is judged as a hit by the cache confirming part 10and the distribution request to this client is notified to the file streaming part 19.
[0038]And the file streaming part 19 reads a cache fileand performs streaming to this client.
[0039]By as mentioned abovethe thing for which the media file and the file of an identical content which a media server holds eventually are accumulated in a cache

server as a cache file. The hit ratio of cash is raised and streaming can be efficiently carried out from a cache server to the demand of a client. Namelysince the media file in which not only the streaming data by which the distribution request was carried out from the client but two or more related streaming data was contained can be accumulated in cashThe hit ratio of cash is raised and it makes it possible to provide streaming from a cache server in the same quality as a media server efficiently to the demand of a client.

[0040]If the distribution request of this media file is published from a client to a media server when the media file is accumulated in the cache server as a cache fileSince it is made to perform streaming instead of a cache server being a media serverthere is an effect which reduces a media server's distribution load by leaps and bounds.

[0041]It can reproduce by a client by installing a cache server in ISP etc.without lowering the quality also about the media file which exists on the media server which cannot connect with a clientif it does not go via the narrow network of a zone.

[0042]When a cache server is in ISP at this timeeven if two or more clients connected to that ISP give a media server the distribution request of the same media fileThe file transfer data which flows between a cache server and a media server requires only the capacitive component of only one media fileand there is an effect which reduces network load by leaps and bounds.

[0043]Although a media file is simply accumulated as a cache file in Embodiment 1 more than embodiment 2.Nextthe embodiment which makes possible easily a large-scale system construction which connects many cache servers to the media server of the case where the network band width between a media server and a cache server is restrictedor one set or a small number is shown.

[0044]Drawing 3 shows the flow of the processing in this embodiment of the invention 2. In a figure1 a cache server and 2 a media server and 3 A client10 -- as for a media file acquisition part and 13a cache file storage and 19 are [a band control part and 103] media file storages a band management department and 14 a file streaming part and 17 a cache confirming part and 101. That isthe band management department 13 and the band control part 14 are added to Embodiment 1.

[0045]The band management department 13 manages the operating condition about an usable networkwhen the media file acquisition part 17 acquires a media file from the media server 2. The band management department 13 is equivalent to a communication rate judgment part.

[0046]The band control part 14 is less than the bandwidth of an usable networkand determines the transfer rate at the time of the media file acquisition part 17 acquiring a media file. The band control part 14 is equivalent to a communication rate set part. The transfer rate determined by the band control part 14 is called setting communication rate.

[0047]Nextoperation is explained.

[0048]Since it is equivalent to Embodiment 1 and operations of the media file

acquisition part 17 or subsequent ones differ about operation of the cache confirming part 10this or subsequent ones is explained.

[0049]The media file acquisition part 17 accesses a media server based on the information received from the cache confirming part 10and stores a media file as a cache file.

[0050]The band control part 14 asks the band management department 13 the network present operating condition in advance of acquisition of the media file by the media file acquisition part 17. The band management department 13 returns network empty bandwidth to the band control part 14. The band control part 14 determines the transfer rate for media file acquisition with a transfer rate smaller than network empty bandwidthand notifies the determined transfer rate to the media file acquisition part 17. At the media file acquisition part 17a media file is received with the transfer rate notified from the band control part 14.

[0051]At this timethe transfer rate for media file acquisition can also be set up beforehand. Namelyit is considered as a transfer rate smaller than the bandwidth returned by the band management department 13 when the empty bandwidth returned by the band management department 13 was smaller than the transfer rate set up beforehandIn being larger enough than the transfer rate to which empty bandwidth was setit uses the transfer rate set up beforehand. Therebyit also becomes possible to acquire another media file during media file acquisition.

[0052]Since this media file was stored as a cache file aboveoperation when the distribution request of this media file is made from another client to the media server 2 is equivalent to Embodiment 1.

[0053]As mentioned abovein this embodimentwhen acquiring simultaneously two or more media files other than the effect of Embodiment 1it makes it possible to share a limited network band effectively.

[0054]Although a media file is simply accumulated as a cache file in Embodiment 1 of the embodiment 3. aboveNextan embodiment in case the cache server 1 and the media server 2 are connected with the optical communication networkand the Internet and a satellite communication network in two or more networkssuch as the Internetis shown.

[0055]Drawing 4 shows the flow of the processing in this embodiment of the invention 3. In a figure1 a cache server and 2 a media server and 3 A clientAs for a file streaming part and 17a cache confirming part and 101 are [a network selecting part and 103] media file storages a media file acquisition part and 16 a cache file storage and 19 10. That isthe network selecting part 16 is added to Embodiment 1.

[0056]The band management department 13 and the band control part 14 which were shown by Embodiment 2 are used togetherand after managing two or more network bandsthe media file accompanied by bandwidth control may be acquired.

[0057]The network selecting part 16 chooses the optimal thing from among thesewhen between the cache servers 1 is connected with the media server 2 in two

or more networks. As a selection criterionit is based on network empty bandwidthand also the network beforehand used according to time to acquire is determined as matrix formand the method of choosing according to it can be considered. This network selecting part is equivalent to a communication-path selecting part.

[0058]Nextoperation is explained.

[0059]Since operations or subsequent ones when it is equivalent to Embodiment 1 and the cache confirming part 10 judges it as a miss hit about operation of the cache confirming part 10 differthis or subsequent ones is explained.

[0060]The cache confirming part 10 transmits the distribution request from this client to the media server 2 as a miss hitwhen this media file was not stored as a cache file and it checks. In this casestreaming of the streaming data is done by the media server 2and the client 3 receives this streaming data and is reproduced. In parallelthe cache confirming part 10 notifies the informationincluding the media server's 2 namean IP addressthe name of a media filesizeetc.which specifies a media file as the network selecting part 16and requires acquisition of a media file.

[0061]The network selecting part 16 selects the optimal network from the network connected between the cache server and the media server. [two or more] Selection may be beforehand registered as a network list etc.may access a media server via a networkand may be judged with the speed of response. When using a network suitable for generally distributing data to a wide areasuch as satellite connectioneffective use of a zone is attained by setting up such a network preferentially. The network selecting part 16 notifies the informationincluding the media server's 2 namean IP addressthe name of a media filesizeetc.which specifies the media file notified from the network and the cache confirming part 10 which were selected in this way to the media file acquisition part 17.

[0062]Via the network selected by the network selecting partthe media file acquisition part 17 accesses the media server 2and stores a media file as a cache file.

[0063]Since this media file was stored as a cache file aboveoperation when the distribution request of this media file is made from another client to a media server is equivalent to Embodiment 1.

[0064]as mentioned abovein this embodimentin order to use efficiently two or more networks connected between [other than the effect of Embodiment 1] the cache server and the media serverit is effective in the ability to make time concerning acquisition of a media file the optimal.

[0065]Circuits mainly used for data transmissionsuch as satellite connection and a TV broadcast circuitcan be effectively used by using together the band management department 13 shown by Embodiment 2and the band control part 14. Since especially the data dissemination by radiosuch as such a satellitecan transmit a media file at once to the cache server with which a wide area is dottedit is efficient compared with transmitting with a cable.

[0066]By Embodiment 1 of the embodiment 4. abovealthough a media file is simply

accumulated as a cache filethe embodiment for next saving the capacity of cash is shown.

[0067]Drawing 5 shows the flow of the processing in this embodiment of the invention 4. In a figure1 a cache server and 2 a media server and 3 A clientAs for a media file acquisition part and 18a cache confirming part and 101 are [a file streaming part and 103] media file storages an access frequency check part and 19 a cache file storage and 17 10. That isthe access frequency check part 18 is added to Embodiment 1.

[0068]The band management department 13 and the band control part 14 which were shown by Embodiment 2 are used togetherand after managing two or more network bandsthe media file accompanied by bandwidth control may be acquired.

[0069]The access frequency check part 18 will be added one timeif the distribution request of the media file to the media server 2 occurs from the client 3and it memorizes the distribution request to this media file. If only the number of times of a distribution request within past predetermined time shall be computed at this timeit can respond to reduction by the passage of time of access frequency to this media file. this access frequency check part 18 — a distribution request — calculation — it is equivalent to a part.

[0070]Nextoperation is explained.

[0071]Since operations or subsequent ones when it is equivalent to Embodiment 1 and the cache confirming part 10 judges it as a miss hit about operation of the cache confirming part 10 differthis or subsequent ones is explained.

[0072]When this media file was not stored by the cache confirming part 10 as a cache file and it is checkedthe distribution request from this client is transmitted to the media server 2 as a miss hit. In this casestreaming of the streaming data is done by the media serverand a client receives this streaming data and is reproduced. In parallelthe cache confirming part 10 notifies the informationincluding the media server's 2 namean IP addressthe name of a media filesizeetc.which specifies a media file as the access frequency check part 18and requires acquisition of a media file.

[0073]The access frequency check part 18 checks the information acquired from the cache confirming part 10 as a miss hitand memorizes how many times it was accessed into predetermined time. That isit is judged as a miss hit by the cache confirming part 10and whenever the distribution request transmitted from the client 3 is transmitted to the media server 2the transmission frequency of a distribution request is counted as access frequency. And the access frequency check part 18 requires acquisition of a media file from the media file acquisition part 17only when this access frequency exceeds a threshold.

[0074]When there are acquisition directions of a media file from the access frequency check part 18the media file acquisition part 17 accesses a media serverand stores a media file as a cache file.

[0075]Since this media file was stored as a cache file aboveoperation when the distribution request of this media file is made from another client to a media server is

equivalent to Embodiment 1.

[0076]As mentioned abovesince only what was accessed by many is stored as a cache file besides the effect of Embodiment 1 in this embodimentthe hit ratio of cash improvesand. Since only what has a high hit ratio is stored in cash as a cache fileit is effective in the cache file storage 101 being used effectively.

[0077]Although a media file is simply stored as a cache file in Embodiment 1 of the embodiment 5. aboveNextthe zone between a cache server and a media server is utilized for the maximumand the embodiment for storing a media file as a cache file as soon as possible is shown.

[0078]Drawing 6 shows the flow of the processing in this embodiment of the invention 5. In a figure1 a cache server and 2 a media server and 3 A clientAs for a dynamic band control part and 17a cache confirming part and 101 are [a file streaming part and 103] media file storages a media file acquisition part and 19 a cache file storage and 15 10. That isthe dynamic band control part 15 is added to Embodiment 1.

[0079]The dynamic band control part 15 always supervises the bandwidth about the network used when the media file acquisition part 17 acquires a media file from the media server 2and determines a transfer rate dynamically according to the change. This dynamic band control part 15 is equivalent to a dynamic communication rate set part.

[0080]Nextoperation is explained.

[0081]Since it is equivalent to Embodiment 1 and operations of the media file acquisition part 17 or subsequent ones differ about operation of the cache confirming part 10this or subsequent ones is explained.

[0082]The media file acquisition part 17 accesses a media server based on the information received from the cache confirming part 10and stores a media file as a cache file.

[0083]Herethe dynamic band control part 15 determines the transfer ratesupervising a transfer rate and making it change dynamically according to change of terms and conditionswhile the media file acquisition part 17 has accessed the media server. It is decided according to CPU of a cache server itself [by the present operation situation of a cache server]a hard diskand the usage condition of a memoryfor example that they will be terms and conditionssupervising the congestion between a media server and a cache serverthe response from a media serveretc. When a transfer rate is generally highin order to use CPU use time and the network band width per unit timeadjusting a transfer rate so that these may be maintained within a predetermined value is mentioned. Thusaccording to the transfer rate dynamically determined by the dynamic band control part 15the media file acquisition part 17 receives a media file.

[0084]Since this media file was stored as a cache file aboveoperation when the distribution request of this media file is made from another client to a media server is equivalent to Embodiment 1.

[0085]As mentioned abovein this embodimentbesides the effect of Embodiment 1at

the time of two or more media file acquisitiona network band is used up to the maximum extentand it is effective in losing the futility of a network resource. In order to also supervise a cache server's own resourceit is effective in not having an adverse effect on original functionssuch as streaming by a cache server.

[0086]Embodiment 6. drawing 7 shows the flow of the processing in this embodiment of the invention 6. in a figure -- 1 -- a cache server and 2 -- as for a media file acquisition part and 19a client and 10 are [a cache file storage and 103] media file storages a file streaming part and 101 a cache confirming part and 17 a media server and 3.

[0087]Nextoperation is explained. Firstthe distribution request to the streaming data contained in arbitrary media files from the client A to the media server 2 is published. Since a distribution request goes via the cache server 1the cache server 1 receives this distribution requestIt is checked whether the media file containing the streaming data which the client A is demanding by the cache confirming part 10 is stored in the cache file storage 101 as a cache file.

[0088]When the media file which contains this streaming data by the cache confirming part 10 was not stored as a cache file and it is checkedthe distribution request from this client is transmitted to the media server 2 as a miss hit. In this casestreaming of the streaming data is done by the media serverand the client A receives distribution streaming data and is reproduced. In parallelthe cache confirming part 10 notifies the informationincluding the media server's 2 namean IP addressthe name of a media filesizeetc.which specifies a media file as the media file acquisition part 17and requires acquisition of a media file.

[0089]The media file acquisition part 17 accesses a media server based on the information received from the cache confirming part 10reads a media fileand starts storing as a cache file.

[0090]Since this media file has not completed storing as a cache file when the distribution request of this media file is made from another client B to a media server in the aforementioned stateit is not generally judged as a hit by the cache confirming part 10. Herethe distribution request to this client B is notified to the file streaming part 19 by not adding collation of the size of a cache file and a media fileetc. to the decision criterion of the hit/miss hit of the cash in the cache confirming part 10.

[0091]After storing in the cache file storage 101 is completedthe file streaming part 19 reads a cache fileand performs streaming to this client B.

[0092]As mentioned aboveeven if a cache server has a media file as a cache file in the middle of storingSince it will be made to perform streaming instead of a cache server being a media server if the distribution request about this media file is published from another client B to a media servershortly after data transfer is started as a cache filein order for the cash of this media file to hitthe convenience seen from the client can be improved besides the effect taken by Embodiment 1and there is an effect which reduces a media server's distribution load further.

[0093]Embodiment 7. <u>drawing 8</u> shows the flow of the processing in this embodiment of the invention 7. In a figure1 a cache server and 2 a media server and 3 A client10 a cache confirming part and 11 a streaming data accumulation part and 12 A streaming data distribution partAs for a file streaming part and 10117 is [a cache-data storage and 103] media file storages a cache file storage and 102 a media file acquisition part and 19. That isthe streaming data accumulation part 11the streaming data distribution part 12and the cache-data storage 102 are added to Embodiment 1.

[0094]The streaming data accumulation part 11 stores the received distribution streaming data while receiving the distribution streaming data in which streaming was done by the media server 2. An information data receive section deserves the streaming data accumulation part 11.

[0095]The streaming data distribution part 12 uses the cache data stored in the cache-data storage 102 according to the distribution request of a clientand performs streaming to a client. From the media server 2from the streaming data accumulation part 11the streaming data distribution part 12 may receive directly the distribution streaming data by which streaming was carried outand may carry out streaming. The streaming data distribution part 12 is equivalent to a data distribution part.

[0096]The cache-data storage 102 stores the distribution streaming data stored by the streaming data accumulation part 11 as cache data. The cache-data storage 102 is equivalent to information data storage.

[0097]Nextoperation is explained. Firstthe distribution request to the streaming data contained in arbitrary media files from the client A to the media server 2 is published. Since a distribution request goes via a cache servera cache server receives this distribution requestIt is checked whether the media file which the client is demanding by the cache confirming part 10 is accumulated in the cache file storage 101 or the cache-data storage 102 as a cache file or cache data.

[0098]The cache confirming part 10 checks whether it is stored in the cache-data storage 102 as cache datawhen the media file containing this streaming data was not accumulated as a cache file and it checks next. When cash is carried out to neitherthe distribution request from this client is transmitted to the media server 2 as a miss hit. In this casestreaming of the streaming data is done by the media serverand a client receives distribution streaming data and is reproduced. The cache confirming part 10 receives the streaming data accumulation part 11 in parallelIt orders to store the streaming data of this media fileand also the informationincluding the media server's 2 namean IP addressthe name of a media filesizeetc.which specifies a media file as the media file acquisition part 17 is notifiedand acquisition of a media file is required.

[0099]The streaming data accumulation part 11 and the media file acquisition part 17 are each methodand start the cash of distribution streaming data and a media file in parallel.

[0100]When the distribution request of this media file is published from the client B to

a media serverin this state the cache confirming part 10For a certain reasona cache file considers it as a miss hit in the middle of storing in the cache file storage 101and considers the cache data in the middle of storing in the cache-data storage 102 as a hit. The cache confirming part 10 requires that the cache data (request-to-receipt information data) in the middle of storing equivalent to this media file should be distributed to the streaming data distribution part 12.

[0101]The streaming data distribution part 12 carries out streaming of the cache data to the client B one by one from the portion stored in the cache-data storage 102.

[0102]If time passesacquisition of the media file by the media file acquisition part 17 and storing in the cache file storage 101 will be completed. If the distribution request to this media file is further published from the client C to the media server 2 in this statethe cache confirming part 10 will require distribution to the client C from the file streaming part 19 by considering a cache file as a hit.

[0103]The file streaming part 19 reads a cache fileand performs streaming to this client C.

[0104]As mentioned abovewhen the distribution request of arbitrary media files occurs from a client to a media serverSince a cache server not only makes this media file a cache filebut stores as cache dataAt the same time the distribution request of this media file other than the effect described by Embodiment 1 is published from a client to a media serverSince the distribution request from other clients comes to perform streaming instead of a cache server being a media serverthere is an effect which reduces a media server's distribution load by leaps and bounds.

[0105]Since cache data and a cache file are stored independentlyBy using together the access frequency check part 18as cache datawhat has many access frequency can be accumulated as a cache fileand whose has few access frequency can improve a user's convenience more.

[0106]Since cache data and a cache file are stored independentlyEven if it is a case where the band control part 14 sets up a transfer rate low enough to such an extent that it does not apply load to a networkand the media file acquisition part 17 acquires a media file with a low transfer rate over many hoursSince the streaming data accumulation part 11 stores cache data in the cache-data storage 102 simultaneously with distribution to the first client AThe cache hit ratio by cache data improvesand there is an effect which keeps the quality of service goodwithout giving load to a network.

[0107]Embodiment 8. drawing 9 shows the flow of the processing in this embodiment of the invention 8. In a figure1 a cache server and 2 a media server and 3 A client10 a cache confirming part and 11 a streaming data accumulation part and 12 A streaming data distribution partAs for a file streaming part and 2017 is [a cache file storage and 103] media file storages a cache-data cutout and 101 a media file acquisition part and 19. That isthe cache-data cutout 20 is added to Embodiment 7.

[0108]As for the cache-data cutout 20the media file acquisition part 17 acquires a

media file from the media server 2When the cache file storage 101 stores a media file as a cache fileWhen the cache data of the same contents as the streaming data contained in a cache file are stored in the cache-data storage 102duplicate cache data are deleted from the cache-data storage 102. The cache-data cutout 20 is equivalent to a data deletion part.

[0109]Nextoperation is explained. Firstthe distribution request to the streaming data contained in arbitrary media files from the client A to the media server 2 is published. Since a distribution request goes via the cache server 1the cache server 1 receives and this distribution request the cache confirming part 10It is checked whether the media file which the client is demanding is stored in the cache file storage 101 or the cache-data storage 102 as a cache file or cache data.

[0110]The cache confirming part 10 checks whether nextit is stored as cache datawhen the media file containing this streaming data was not stored as a cache file and it checks. When cash is carried out to neitherthe distribution request from this client is transmitted to the media server 2 as a miss hit. In this casestreaming of the streaming data is done by the media serverand a client receives distribution streaming data and is reproduced. The cache confirming part 10 receives the streaming data accumulation part 11 in parallelIt orders to receive and store the streaming data of this media fileThe informationincluding the media server's 2 namean IP addressthe name of a media filesizeetc.which specifies a media file as the media file acquisition part 17 is notifiedand acquisition of a media file is required.

[0111]The streaming data accumulation part 11 and the media file acquisition part 17 are each methodand start the cash of distribution streaming data and a media file in parallel.

[0112]When the distribution request of this media file is published from the client B to the media server 2in this state the cache confirming part 10For a certain reasona cache file considers it as a miss hit in the middle of storing in the cache file storage 101and considers the cache data in the middle of storing in the cache-data storage 102 as a hit. The cache confirming part 10 requires that the cache data in the middle of storing equivalent to this media file should be distributed to the streaming data distribution part 12.

[0113]The streaming data distribution part 12 carries out streaming of the cache data to the client B one by one from the portion stored in the cache-data storage 102.

[0114]If time passesacquisition of the media file by the media file acquisition part 17 and storing in the cache file storage 101 will be completed. The media file acquisition part 17 will require deletion of the cache data (overlapping cache data) corresponding to this media file from the cache-data cutout 20if acquisition of a media file and storing in the cache file storage 101 are completed.

[0115]The cache-data cutout 20 deletes the cache data (overlapping cache data) corresponding to this media file from the cache-data storage 102.

[0116]If the distribution request to this media file is further published from the client

C to the media server 2 in this statethe cache confirming part 10 will require distribution to the client C from the file streaming part 19 by considering a cache file as a hit.

[0117]The file streaming part 19 reads a cache fileand performs streaming to this client C.

[0118]As mentioned aboveif acquisition of a cache file is completedin order to delete unnecessary cache datathe storage area of a cache server other than the effect explained by Embodiment 7 is savedand it becomes possible to use effectively.

[0119]Although above Embodiments 1-8 explained the data communication unit concerning this inventionthe data communication method which starts this invention with the same procedure is also realizable.

[0120]Herethe re-word of the feature of the cache server device shown by Embodiments 1-8 and a caching method is carried out below.

[0121]The cache server device and caching method concerning Embodiment 1A cache server exists between the client which reproduces streaming mediaand the media server which distributes a media fileIt is judged whether the media file demanded from the client exists in a cache server as a cache fileWhen this cache file is distributed from a cache server to a client when a cache file existsand a cache file does not existIn the streaming system which carries out cash of the media file which had the demand from the client to a cache server from a media serverWith reference to the distribution request of the media file published from a client to a media servermanage the whereabouts of a media fileand. The cash verifying means which judges whether the demanded media file exists in a cache server as a cache fileA file streaming means to distribute this cache file from a cache server to a client when a cache file existsIt has a media file acquisition means which acquires as a file this media file of which distribution was required from the client from a media server.

[0122]The cache server device and caching method concerning Embodiment 2It has a band management means to manage the usage band width of the network for acquiring a media file in a media serverand a bandwidth control means to determine to acquire a media file with a transfer rate smaller than the bandwidth which can be used now.

[0123]The cache server device and caching method concerning Embodiment 3Two or more networks connected to the cache server when a cache server and a media server can communicate in two or more networks mutuallyand a band management means to manage each usage band widthThe feature of having a network selecting means which determines the network as for which the zone is most vacant out of two or more networks as the network for media file acquisition from a media server is carried out.

[0124]The cache server device and caching method concerning Embodiment 4When the threshold which computed the number of times of a distribution request of the media file demanded from the clientand this number of times of a distribution request

set up beforehand is exceededit has an access frequency verifying means which determines to acquire a media file.

[0125]When the cache server device and caching method concerning Embodiment 5 acquire a media file as a cache filethey are provided with a dynamic bandwidth control means to fluctuate a transfer rate dynamically according to usable bandwidth.

[0126]The cache server device and caching method concerning Embodiment 6When the distribution request to this media file occurs from a client to a media server in the midst of acquiring the media file as a cache fileit distributes from the cache file in the middle of acquisition to a client.

[0127]The cache server device and caching method concerning Embodiment 7With reference to the distribution request of the media file published from a client to a media servermanage the whereabouts of a media fileand. The cash verifying means which judges whether the demanded media file exists in a cache server as a cache file or cache dataA streaming data accumulation means to accumulate as cache data from a media server with reference to the streaming data distributed to the clientIt has a streaming data distribution means to distribute the accumulated cache dataWhen a cache file does not existthis streaming data is temporarily memorized as cache dataWhen the distribution request of a media file occurs from a client to a media serverbefore completing acquisition of a media filedistribution is performed from cache dataand after acquisition of a media file is completeddistribution is performed from a cache file.

[0128]The cache server device and caching method concerning Embodiment 8 were provided with the cache-data deleting means which deletes cache data after acquisition of the media file was completed.

[0129]

[Effect of the Invention]According to this inventionwhen the information data file containing the demand information data by which the distribution request was carried out from the terminal unit is not stored in the file storing parta data communication unitSince a demand information data file is received from a distribution system and the received demand information data file is stored in a file storing partHenceforthwhen the distribution request about the information data more nearly same than another terminal unit is transmittedinstead of a distribution systemstreaming of demand information data can be performed from the information data file stored in the file storing partand there is an effect which reduces the distribution load of a distribution system by leaps and bounds.

[0130]Even if the demand information data which a terminal unit requires is information data held by the problem of the zoneetc. with the distribution system with difficult streaming according to this inventionIf a data communication unit is installed in ISP etc.streaming can be carried out to a terminal unit from a data communication unitwithout lowering the quality of demand information data.

[0131]If a data communication unit is installed in ISP etc. according to this

inventionEven if two or more terminal units connected to the ISP transmit the distribution request to the same information datathe data volume which flows between a data communication unit and a distribution system requires only the capacitive component of only one information data fileand there is an effect which reduces network load by leaps and bounds.

[0132]According to this inventionsince a data communication unit judges a communication rate usable to reception of a demand information data file and sets up a setting communication rate based on an usable communication rateit can utilize a limited network band effectively.

[0133]When the data communication unit is connected with the distribution system via two or more communication paths according to this inventionTwo or more communication paths can be efficiently used by choosing the optimal communication path for reception of a demand information data file from two or more communication pathsand it is effective in the ability to make the optimal time concerning acquisition of an information data file.

[0134]In order that according to this invention a data communication unit may calculate accumulation of the transmission frequency of the distribution request to a distribution system for every demand information data and enumerated data may acquire an information data file only about the demand information data beyond a predetermined thresholdWhile the information data file whose probability by which a distribution request is carried out is higher than a terminal unit is stored in a file storing part and the distribution load of a distribution system is reducedthe situation where the data volume of the information data file stored in a file storing part becomes excessive is avoidable.

[0135]According to this inventionin order that a data communication unit may set up dynamically the communication rate used for reception of an information data fileit uses up a network band to the maximum extentand is effective in losing the futility of a network resource. In order to also supervise a data communication unit's own resourceit is effective in not having an adverse effect on original functions of a data communication unitsuch as streaming.

[0136]Even if according to this invention it is a case where the distribution request about the same demand information data is received from a new terminal unit before a data communication unit completes storing of a demand information data fileSince a data communication unit performs streaming of demand information data to a new terminal unit after storing of a demand information data fileit can improve the convenience seen from the terminal unitand there is an effect which reduces the distribution load of a distribution system further.

[0137]According to this inventionwhen a data communication unit receives a distribution request from a terminal unitwhile it receives a demand information data file from a distribution systemSince the demand information data by which streaming is carried out is received from a distribution system to a terminal unitEven if it is a

case where the distribution request about the same demand information data is received from a new terminal unit before storing of a demand information data file is completeda data communication unitStreaming of request-to-receipt information data can be performed to a new terminal unitthe convenience seen from the terminal unit can be improvedand there is an effect which reduces the distribution load of a distribution system by leaps and bounds.

[0138]According to this inventionwhen a data communication unit overlaps [the information data in a file storing part and the information data in information data storage]in order that the overlapping information data in information data storage may be deletedit saves the storage area in a data communication unitand it becomes possible to use effectively.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The block diagram showing the system configuration of this invention.
[Drawing 2]The block diagram showing the processing in this embodiment of the invention 1.
[Drawing 3]The block diagram showing the processing in this embodiment of the invention 2.
[Drawing 4]The block diagram showing the processing in this embodiment of the invention 3.
[Drawing 5]The block diagram showing the processing in this embodiment of the invention 4.
[Drawing 6]The block diagram showing the processing in this embodiment of the invention 5.
[Drawing 7]The block diagram showing the processing in this embodiment of the invention 6.
[Drawing 8]The block diagram showing the processing in this embodiment of the invention 7.
[Drawing 9]The block diagram showing the processing in this embodiment of the invention 8.
[Description of Notations]
1 A cache server and 2 A media server and 3 A client and 4 Network10 A cache confirming part and 11 A streaming data accumulation part12 streaming data distribution part13 A band management department and 14 A band control part15 dynamic band control partand 16 Network selecting part17 A media file acquisition part18 access-frequency check partand 19 [A cache-data storage and 103 / Media file storage.] A file streaming part and 20 A cache-data cutout and 101 A cache file

storage and 102